DEC 31 1923

The JOURNAL of GEOGRAPHY

VOLUME XXII DECEMBER, 1923 NUMBER 9

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STUDIES IN THE GEOGRAPHY OF BRAZIL
WILLIAM H. HAAS

BRAZIL'S PLACE IN THE RUBBER WORLD —A PROBLEM IN UPPER GRADE GEOGRAPHY
MARGUERITE UTTLEY

FOREIGN TRADE ROUTES OF BOLIVIA
W. O. BLANCHARD

THE TRANSPORTATION PROBLEM OF HIGHLAND COLOMBIA
PRESTON E. JAMES

THE ISLAND OF OAHU
WILLIAM M. DAVIS

Published by A. J. Nystrom & Co., for The National Council of Geography Teachers
George J. Miller, *Editor and Secretary*

THE JOURNAL OF GEOGRAPHY

A MAGAZINE FOR TEACHERS

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Business office of Journal of Geography

A. J. NYSTROM & CO.
2249 Calumet Ave., Chicago, Ill.

SUBSCRIPTION TERMS

The subscription price is $2.00 a year, payable in advance; the price of single copies is 25 cents. Orders for less than a half year will be charged at single-copy rate. Postage is prepaid by the publishers on all orders from the United States, Mexico, Cuba, Porto Rico, Panama Canal Zone, Republic of Panama, Hawaiian Islands, Philippine Islands, Guam, Samoan Islands, Shanghai. Postage is charged extra as follows: For Canada, 30 cents on annual subscriptions (total $2.30), on single copies 3 cents (total 28 cents); for all other countries in the Postal Union, 52 cents on annual subscriptions (total $2.52), on single copies 6 cents (total 31 cents).

The *Journal* is the official organ of the National Council of Geography Teachers and is sent to all members of the organization. The annual dues, $1.50, are payable to the *Journal of Geography*. Extra postage rates for copies sent to foreign countries should be added to the membership dues.

Patrons are requested to make all remittances payable to the *Journal of Geography*, in postal or express money orders or bank drafts.

Members and subscribers who wish to continue receiving the *Journal* must send remittances promptly to assure the volume being complete.

Send manuscript and books for notice or review to the *Editor*.
Send orders for back numbers to *Journal of Geography*.

Agent for Great Britain. Arthur F. Bird, 22 Bedford Street, Strand, London, W. C. 2.

Published monthly except June, July and August

PUBLICATION OFFICES: 450 AHNAIP STREET, MENASHA, WISCONSIN

All Business Correspondence, Membership Dues, and Subscriptions should be sent to

A. J. NYSTROM AND COMPANY,
PUBLISHERS, JOURNAL OF GEOGRAPHY,
2249 CALUMET AVENUE, CHICAGO

Entered as second-class matter January 15, 1919, at the postoffice at Menasha, Wisconsin, under the Act of March 3, 1879.

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Miss Uttley is an assistant professor of geography in the State Teachers College at Cedar Falls, Iowa and a leader in geographic education. She is author of a "Series of Lesson Plans in Geography for the Seventh Grade" and co-author of a "Course of Study in Geography for the Elementary Schools of Iowa." Teachers should read again her article, "The Commerce of the Hawaiian Islands—A Seventh Grade Problem," which appeared in the February, 1923, *Journal.*

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The JOURNAL of GEOGRAPHY

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VOLUME XXII DECEMBER, 1923 NUMBER 9

STUDIES IN THE GEOGRAPHY OF BRAZIL

WILLIAM H. HAAS

(Continued from November)

THE IMPORTANCE OF BELEM[10]

Belém is the port for this vast hinterland and commands the entire Amazon Valley as all boats take the narrow arm of the Amazon known as the Pará River. All boats take this somewhat roundabout route due to the quieter waters of the Pará River and to avoid the strong tidal bore in the mouth of the main stream. The city is located 120 km. from the ocean and is therefore not a port of call for east coast vessels. The eastward extension of the continent also isolates the basin both from American and European trade routes; moreover, the basin already is isolated in interest from the rest of Brazil both by distance and by difference in products. Belém will prosper only in proportion as the hinterland has products which the outside world is anxious to get.

The city was founded in 1616 and its development was slow in the beginning but extraordinarily rapid during the rubber boom days. In 1649 it already had a population of 6,500 and by 1851 there were only about 18,000 people; but by 1873 it had 35,999; 1883, 60,000; 1895, 100,000; 1907, 192,000; and in 1918 about 240,000. Altho the rubber industry began about 1820 with a production of about 30 tons the growth was slow until the remarkable expansion of the rubber tire industry. The Brazilian rubber industry was at its best from 1909 to 1912 when Brazil exported over 42,000 tons of rubber or about two-thirds of the world's total. The rapid rise of plantation rubber of 531 tons in 1906 to 271,000 tons in 1921, has destroyed

[10] Belém is known also as Pará. The full name is Santa Maria de Belém do Grão Pará with a preference to Belém by the Brazilians. Many other Brazilian cities have more than one name such as São Luiz or Maranhão. Recife properly is part of Pernambuco. The full name for Bahia is São Salvador da Bahia de Todas os Santos (Holy Savior of the Bay of All Saints). Even the full name of the Spanish-American metropolis is Nuestra Senora a Virgen Maria de los Buenos Aires (Our Lady, the Virgin Mary of the Good Winds).

not only Brazil's monopoly of the industry but almost the entire rubber trade due to the high cost of getting out the wild rubber. In 1920 Brazil exported less than 20,000 tons. During the height of the rubber boom prosperity ran wild, the evidence of which adds to the decadent appearance of the city today. The difference in the times is shown by the port movement. In 1909 there were 1,672 ships of 2,040,000 tons and in 1916 only 585 ships of 640,000 tons. Altho the streets of the city are well paved from stones carried in ballast and the town has electric light and tramway, yet some of the streets today are grass covered with open sewers in which the "urubú" (buzzard) wades in search for food within a few feet of the passerby.

THE TEMPERATURE

One of the leading factors to be considered in the development of the region is the climate. This by no means is ideal, yet it is not as bad as most people suppose. The Amazon lower basin is known, and

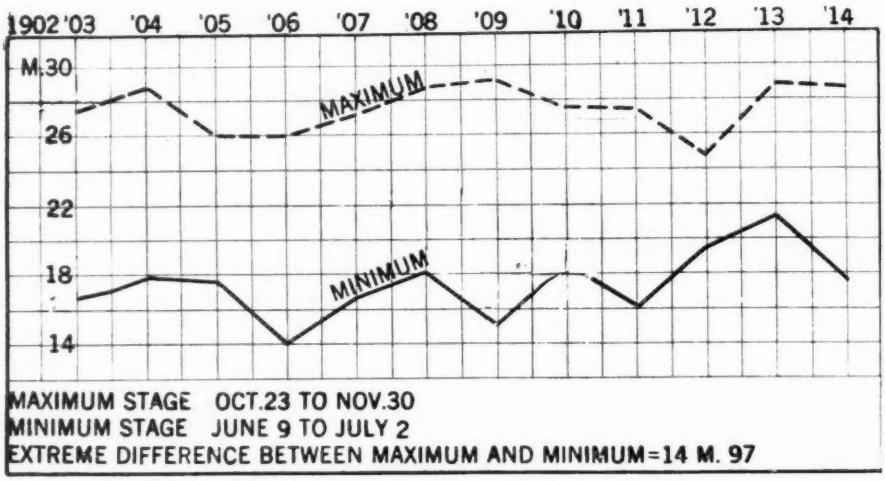

FIG. 13. The maximum and minimum height of the Amazon at Manáos in meters thru a series of years. In a region where so much of the land is low the difference in the amount of land flooded, even at low stage, is tremendous. This must be taken into consideration in any development. A high minimum stage as in 1913 practically limits the development to land above this level.

rightly so, for its constant high temperatures, yet the thermometer rarely rises to 34° C. (93.2° F.) The mean annual as given by Hann for Belém after nine years of observation is 25.1° C. (77.2° F.). This gives a fairly accurate idea for the whole year as there are no great variations from the mean in the lowlands. The temperatures for the interior are slightly higher. Temperatures naturally vary depending

on the part of the basin taken, the greater the distance from the Amazon, the greater the range of temperatures in the main, altho, according to Supan, the heat equator extends across the mouth of the Amazon thru the Guyanas, Venezuela, and Central America. The prevailing east and northeast winds keep down the otherwise high temperatures in the basin. The chief thing that characterizes the region, however, is the constancy of the high temperatures as may be noted in the following grafs.

The grafs show the constancy of the heat thruout the year and thruout the twenty-four hours. The slight seasonal ranges manifest are due less to the position of the sun than to other factors. At Belém February is the wettest month and has the lowest temperature; November is driest and also the hottest. At Obidos and Manáos the lowest temperatures are in March and April, owing chiefly to the cold southwest winds from the Andes known as "friagems." During

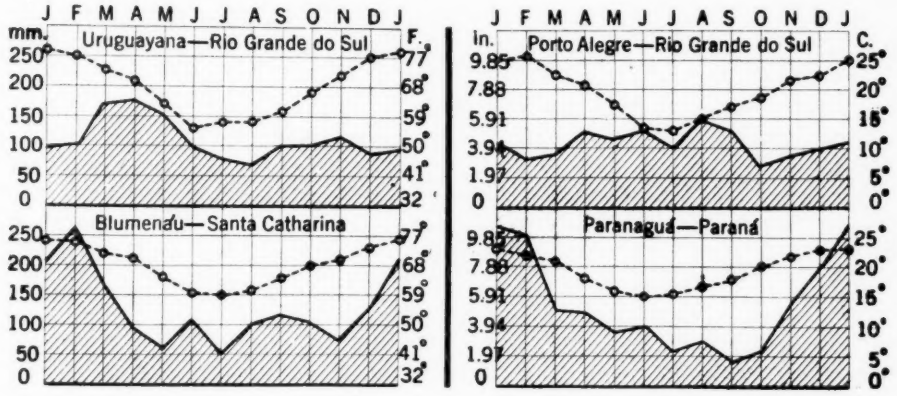

FIG. 14. Mean monthly temperature and rainfall for representative places in South Brazil. Shaded areas show rainfall both in inches and millimeters. Single lines temperature on both C. and F. each. Uruguayana is in the extreme west of Rio Grande do Sul, Porto Alegre is almost due east near the coast, Blumenau is near the east coast of Santa Catharina, and Paranaguá is a seaport of Paranâ.

Uruguayana	Total precipitation	53.2	inches	Mean	Ann.	Temp.	64.1°	F.
Porto Alegre	" "	51.2	"	"	"	"	64.3	"
Blumenau	" "	57.8	"	"	"	"	67.6	"
Paranaguâ	" "	68.5	"	"	"	"	66.7	"

these "friagems" on the upper Madeira the temperature has been known to drop in a few hours from 38° C. to 11° C. The people are very sensitive to any departure from the general mean and during these winds actually suffer from cold. Similarly when the temperature rises a few degrees above the normal people again suffer and the air seems to them like a fiery furnace. The mornings seem

delightfully cool at 22° C. The usual drinking water in porous jugs is at 24° C. or 25° C. and water two or three degrees cooler is considered cold.

THE RAINFALL

Along the Amazon it rains a great deal and there is a rainy and less rainy season near the mouth and a distinct wet and dry season farther in the interior. The sky is rarely bright blue and there is almost always a haze along the horizon. The average cloudiness is 5.35 at Obidos and 6.3 at Manáos. On moonlit nights the whiteness

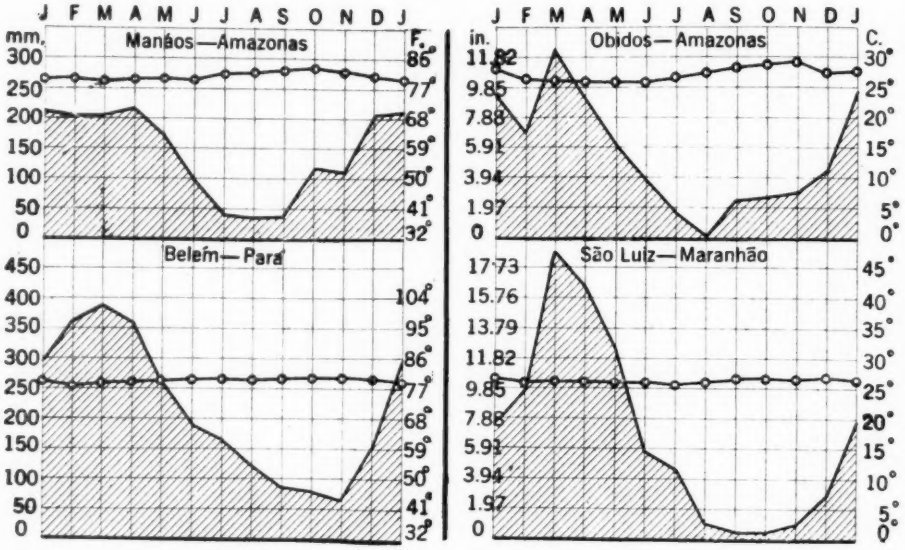

FIG. 15. Average monthly temperature and precipitation of four places within four degrees south of the equator. Shaded areas show rainfall in both millimeters and inches; single line shows temperature on both Centigrade and Farenheit scales.

Manâos	Total Precipitation		65	inches;	mean an.	temp.	80.9°	F.
Obidos	"	"	63	"	"	"	80.9	"
Belém	"	"	98	"	"	"	79.1	"
São Luiz	"	"	76	"	"	"	79.3	"

of the light is one of the very striking features. In general, the rain is in the afternoon, evening or night. There is considerable difference of rainfall in the various towns along the Amazon. The mean at Belém is 2,486 mm. (97.95 in.), at Obidos 1,592 mm. (62.75 in.), and at Manáos 1,657 mm. (64.29 in.) The maximum (2,926 mm.) at Manáos is more than twice the minimum at Obidos (1,405 mm.). Exceptionally heavy showers are not uncommon and for Belém the maximum recorded in 24 hours is 206 mm. (8.1 in.)

In the valley itself there is considerable difference also in the distribution of the rain. At Belém it is rare for a week to pass in which some rain does not fall. At Obidos on the other hand, nearly every year there is more than a month during which little or no rain falls. From June 24 to September 18, 1903 (78 days) there fell only 16 mm. of water and this is not exceptional. During the dry season the traveler may see certain tracts of cut down forest set on fire and burning with an intensity that is surprising. Occasionally the fires sweep into the forest itself, but as the trees are not very inflammable and as the rapid oxidation keeps the floor of the forest fairly bare

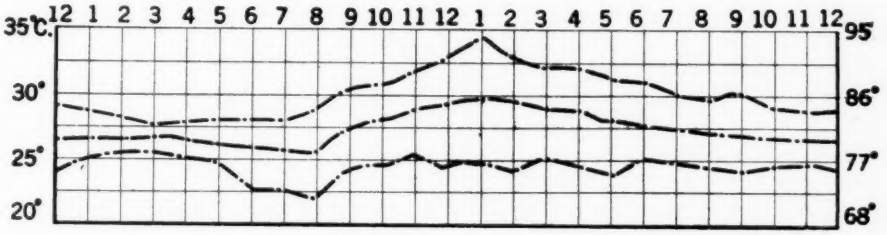

FIG. 16. Hourly temperatures at Belém from midnight to midnight, the extremes and the mean. The data are the result of 3,772 observations taken from 1861 to 1867 on a vessel in the port where conditions are more normal than in the city. The maximum recorded is 94.2° F. and the minimum 71.6°. Showing a range of 22.5° F. "The night is the winter of the tropics" is scarcely true here.

fires do not make much headway. The smoke from such forest fires has been dense enough, however, to make river navigation at night impossible.

In the upper reaches of the basin the rainfall is much heavier. At Pebas the rainy season is almost thruout the entire year. It is estimated that at Teffé the rainfall is twice as heavy as at Obidos. By the time Iquitos is reached there is another zone of lesser rainfall with August as the driest month. The annual rainfall is given here as 2,840 mm. with an annual temperature of 24.8° C. On the eastern slope of the Andes there are almost incessant rains, and by far the greater amount of water of the Amazon falls upon the slope as the numerous rivers in this section show so markedly. In the northern part of the basin or Upper Negro, April, May and June are the rainy months. In southern regions, as in Acre, the rainy months are from September to April and the driest months are June and July. This brings about many interesting conditions as the waters shift from one side of the Amazon channel and side channels to the other.

The Rise and Fall of the Waters

The flatness of the basin does not give any chance for springs. When the rains cease, the rivers drop rapidly. The soil has so little humus that little water is stored at the surface, and during the dry season the average sized river is only a brook or only a series of muddy pools. As the water rises and as the end of the rainy season approaches, only the tops of the ridges in the alluvial plain stand above water. It is here on these "tesos" that game and cattle find refuge. Houses must be built either on the "tesos" or else on piles and communication during this period is only by boat. As the water again recedes, health conditions, due to the decaying vegetation, get bad; yet, with a few rains, the dreary unforested areas are transformed rapidly into splendid pastures from which grasses rise as if by magic.

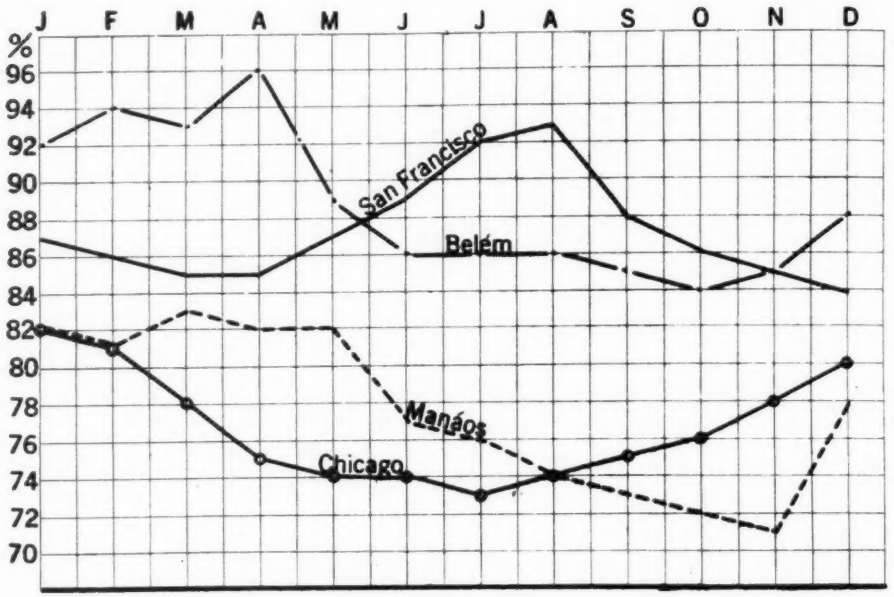

FIG. 17. Relative humidity in percentages, normal values, at San Francisco and Chicago, 8:00 A. M.; Pará (Belém) and Manáos, general mean. In the tropical cities high humidity goes with the rainy season; in Chicago, high humidity goes with the cold season; and in San Francisco, high humidity goes with the dryest but foggiest season.

Problems in the Development

The problem of the development of such a region is a complicated one, especially a development which requires rather intensive application and permanent improvements. It is true that with proper regard for food, drink, rest, and sanitary conditions, in an intelligent

community where good medical attention is available, people can and do live in tropical regions without any special ill effects and with a death rate as low as in higher latitudes. On the other hand, to live and work as a colonist must, under persistent high sensible temperatures, in a malarial region where a screened window is a luxury not to be afforded, with no way of keeping even dry foods uncontaminated or of having even a semblance of a balanced ration, with no way of having pure water except by boiling, and then always drinking warm water, with neither medical attention nor even the simplest medicines to be had, is a life for which the white man, at least, does not seem adapted.

Another of the problems is the insect pests. Too little attention, probably, has been given by writers to the life which keeps man and his domestic animals from rest either by day or night. An English mining engineer of the interior uplands suggested that one might think his conception of heaven to be a city paved with gold with curbing set in diamonds, but not so—his heaven was "a place where neither man nor beast ever needs to scratch." When it is not one kind it is another, some to plague man by day, others to keep him from rest at night. There are the "mucuims," "pium s," "meruims," "carapanas," "mutucas," bixos do pe," and a host of others. There are not only the blood suckers, but also the skin borers, those which enter the skin there to develop or to raise a brood. Besides these there are hordes of gnats which get into eyes and ears. Such pests of course are not common or even present in many of the towns and probably would disappear quite generally with more intensive development.

There are other problems for the individual colonist or for those who plan developments on a large scale. The flooding which takes place in various parts of the basin at various times of the year is a most serious one. These overflows are the result not of the rainfall of the regions but of other sections. There is the migration of the rain belt from one side of the Amazon to the other; also the period of melting snows which causes the greater rise in the Amazon. Lands that are flooded periodically cannot hope for very much permanent improvement other than in the culture of trees not hurt by such overflows. Such overflows add also to the problems of the unflooded parts for the colonist is never sure to what height the river may rise. Moreover, in such a region drainage can never be complete, leaving breeding places for the anopheles mosquito, the bearer of malaria, the most serious of all the diseases of the basin.

SECTIONAL DEVELOPMENT

This region is made up of the major portions of two states, Amazons and Grão Pará, and the territory of Acre and parts of neighboring countries. The territory of Acre has an area of about 60,000 sq. mi. and a population of about 95,000. The capital, Rio Branco, has about 15,000 people. Cotton, sugar, tobacco, mandioca, rice, maize, potatoes and beans are grown for food. The chief export is rubber with some Brazil nuts, woods, hides and skins. The difficulty of getting the products out limits the type of commodities. It is said the region has great livestock and agricultural possibilities were there a market.

Amazonas is by far the largest state in the union with an area of about 731,000 sq. mi., larger than any state in Europe except Russia. The population is estimated at 460,000 and next to Matto Grosso (.3 per sq. mi.) is the least densely populated (.6 per sq. mi.). This population is by no means permanent and fluctuates greatly with the season due to the overflow and to the coming and going of the rubber gatherers. The number of people from year to year varies also according to the price of rubber and to climatic conditions in Ceará. The Amazon basin has been peopled largely by the "Cearense" during extended periods of drought in that state.

Practically, the only product of importance in the state is rubber. The amount produced fluctuates greatly according to price. In 1913 out of a total export of less than 77,000 contos rubber accounted for 75,000 contos for 16,000 metric tons. Five years later during a period of great depression the export of rubber was only 8,256 metric tons with a value of 28,000 contos. In 1920 the total shipments of rubber rose again to 12,000 tons valued at 30,000 contos. The other products of export are Brazil and oil nuts, hides and skins, cacao and tonka beans, wood and extracts, and a few minor items. Due to the dependence upon a single commodity for revenue not only the people but the government itself finds it difficult to live within the revenues. In 1906 during the period of boom the state floated a loan of 84,000,000 francs at 5 per cent, but payments now are suspended up to 1925 in the hope for better times.

The state of Grão Pará has an area of 444,000 sq. mi., nearly twice that of Texas, and an estimated population of 984,000 of which 236,000 live in Belém, the capital. The main interest centers around rubber, yet not as exclusively so as in Amazonas. The export in the value of contos for 1920 was manioc 8,060; rubber, 8,015; Brazil nuts

4,990; woods 4,840; rice 2,400; cacao 2,175; hides and skins 1,130; cotton 725; corn 450; and other minor items. There is considerable variation in the rubber exported from year to year. In 1919 Pará shipped 17,763 tons valued at 54,000 contos and in 1921 only 7,258 tons, valued at 14,000 contos. Unlike rubber, the importance of the Brazil nut is increasing. The chief handicap in the development of the industry is their spoiling while in transit due to the extreme heat developed in the holds of ships from the "sweating" of hides, rubber and nuts. There seems no reason why some of the other commodities should not enlarge the export trade in the near future.

THE ENTIRE DEVELOPMENT OF THE BASIN

The development of the basin has not been nearly as rapid as the important products of the region might have foreshadowed. Coffee was one of the early important products having an annual expórt from 1773 to 1776 of 49 metric tons. By 1778 it had reached its climax and then the production fell until the export disappeared entirely in 1895. In 1913 Manaos alone imported 2,036 tons. Similarly, sugar once held a relatively high place. From 1836 to 1852 the average annual export was 206 tons. During the next ten years the export dropped, in spite of the opening of steam transportation, to an average of 157 tons. The amount exported fell gradually until about 1903 when it disappeared entirely. At the present time not enough is grown for the manufacture of "cachasa," the aquardiente of the west coast. Even as early as 1774 cotton was exported but after 1800 there was a gradual decrease until it had almost disappeared. Tobacco similarly was grown fairly generally, but during the rubber period practically disappeared. The Brazil nut and the cacao bean also had an early start, but show slightly different results. The average annual export of the Brazil nut for 1836-1851 was 30 tons, by 1880 it was 105 tons, the 1901-1910 average was 142 tons, and for 1919 it was 557 tons. As the tree grows wild and is not destroyed in its exploitation, the only modifying human factor is in the gathering. With cacao it is different. Altho one kind of bean is native to the basin, practically all is produced from plantations. The average annual export from 1852-1862 of 3,076 tons was almost equal to that of 1915-1918 of 3,704 tons. For a time the increase was slow, then rapid up to 1888, the banner year, with 7,539 tons. However, with the rubber boom plantations were abandoned and many at present along the Amazon look as tho the land again had reverted largely to the wild

state. The basin is said to be almost ideal for the growing of the bean and the crop to yield splendid returns on the efforts expended.

About the middle of the last century high hopes were held for the rapid development of the region. Even our own government sent an expedition under Lieut. Herndon of the U. S. Navy to investigate the possibilities. In his report he compared the Amazon basin to the Mississippi Valley and suggested that Belém was more favored by nature than New Orleans and in fifty years would be the largest city in the New World. It was during this period that steam navigation on the Amazon was established (1851) and the Amazon was thrown open to the merchant ships of the world (1867). In 1866 the Booth line started steam service to Liverpool and a new era in activities of the Amazon.

In the early fifties the average yearly values of exports from Belém as given by the then French consul, Chaton, at Belém were as follows:

India rubber	$552,000	Sugar	$ 16,002
Cocoa	270,000	Sarsaparilla	35,073
Cotton	10,583	Nuts	18,952
Cinnamon	1,683	Tapioca	3,000
Vegetable wax	69	Carajurú	388
Tonka beans	600	Green hides	20,345
Isinglass	15,968	Guaraná	1,500
Piassaba rope	42,192	Cattle	4,500
Gum-copal	634	Wood	4,700
Bones	640	Dry hides	19,445
Brazilian nutmeg	3,060	Tiger skins	456
Rice (shelled)	65,126	India Rubber shoes	38,400
Rice (in husk)	6,400	Molasses	2,888
Annatto	36,050	Total	$1,171,541

But even then a decadence had set in, seemingly, for the first president of Amazonas declared at that time that formerly agriculture had prospered; that the culture of cotton, indigo, rice, coffee, tobacco, and manioc had sufficed for local consumption and even had supplied several factories; but that now agriculture and other industries had decreased or almost disappeared.

THE LATER DEVELOPMENT

The later economic development has not been as great as was anticipated. The reason, in part at least, is due to the fact that the later development due almost entirely to rubber was exploitive of a

wild product. When the rubber trade was over there was not only no advancement to be seen, but rather rubber trees and the real industries of the region ruined. The mushroom growth may be noted in part from the following population statistics.

	1872	1890	1916	Present
Amazonas	275,237	328,455	780,000	984,000
Pará	57,610	147,915	290,000	460,000
Acre	.....	.....	40,000	95,000
Total	332,847	476,370	1,100,000	1,539,000

The evolution of the rubber industry is a story all its own. The development of the industry at first was regular, later rapid, and recently bringing disaster. It produced about 380 tons in 1840; 10,300 in 1880; 16,393 in 1890; 26,747 in 1900; 38,039 in 1910; 43,362 in 1912, the banner year; and in recent years between 30,000 and 35,000 tons. The industry at the present writing is again picking up due to the higher prices resulting from the "Stevenson plan." This plan, by a sliding scale of export taxes, restricts the exports under the British flag to 60 per cent of the 1920 crop. When the price reaches about 30 cents, the tax is adjusted up until the product reaches about 90 cents per pound when 100 per cent production again will be permitted. As a result of the increase in price due to this restriction the United States Department of Commerce is planning to develop the industry in Brazil.

There seems to be no reason why Brazil should not produce rubber as cheaply as the Orient. It has been estimated that there are between two and three million trees, more than nine-tenths of which have never been touched. Many more millions could be planted. It is not a question of trees nor of the quality of the rubber, but a question of cost of production. The high cost of production is due mainly to the fact that the cost of food in the region is much higher than it need be and second, the cost of bringing the rubber out is also greater than it need be. Due to the careless tapping the "seringuero" has been forced gradually to go farther into the interior away from the natural water courses. To get food in and to get the rubber out is a tremendous task expecially under existing conditions. It may be however, that in the "black gold of the Amazon" still lies the greatest future for this enormous tropical expanse.

BRAZIL'S PLACE IN THE RUBBER WORLD*

A PROBLEM IN UPPER GRADE GEOGRAPHY

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As recently as 1910 Brazil was the leading rubber producing country in the world. Fully two-thirds of the raw rubber supplied to the various rubber manufacturing industries came from Brazil. This country which once possessed a natural monopoly in crude rubber has dropped to an unimportant place within the last decade. Now, only about one-twelfth of the world's rubber comes from Brazil. With the rapid increase in the consumption of rubber for automobile tires, the demand for raw rubber has increased by leaps and bounds. From four to five times as much raw rubber is consumed to day as was used in 1910.[1] With the opening of new and larger markets, why has Brazil failed to expand its industry and keep its place as the leading rubber producer?

This problem suggests two lines for investigation. (1) Why is Brazil unable to increase rubber production profitably? (2) Why did other regions of the world develop a new rubber industry and outdistance Brazil?

INABILITY OF BRAZIL TO INCREASE RUBBER PRODUCTION PROFITABLY

The search for facts to establish the above suggested solution entails investigation by the children of the rubber industry in Brazil. The following references are well adapted to seventh grade use.

1. Bowman, South America. pp. 251-265
2. Allen, South America. pp. 117-123
3. Browne, South America. (Peeps at Many Lands Series.) Ch. V
4. La Varre, Brazil's White Gold. *Bulletin Pan American Union*, Vol. 51, pp. 466-475
5. Smith, Human Geography. Book II, pp. 381-383
6. McMurry and Parkins, Advanced Geography. pp. 253-255
7. Brigham and MacFarlane, Essentials of Geography. Book II, pp. 288-289

The facts gathered must next be organized. The following outline is suggested.

I. Location of the rubber region of Brazil, as to,
   1. Political divisions
      Major parts of the states of Para and Amazonas and the territory of Acre

* Miss Uttley's article was prepared especially for our special number on Brazil. It not only illustrates how a real teacher may attack the problem by use of the abundant material supplied on Brazil, but suggests numerous possibilities for using the great amount of excellent subject mattef that may be found in the *Journal* regularly.—Editor.

1. W. O. Blanchard, Changes in the Rubber World. *Journal of Geography*, October, 1920, p. 19

2. Surface features

Lowland of the Amazon Basin. (See Dr. Haas's article on Amazonas in the November number.)

II. Area of region dominated by the rubber industry

1. Para..... 444,000 square miles
   Amazonas..... 731,000
   Acre..... 60,000

   1,235,000

2. Comparison with the area of the United States

III. Location of rubber trees, with reference to,

1. Rivers
   1) On islands in the mouth of the Amazon and in its lower branches
   2) On flood plains of the upper Amazon and its tributaries
   3) Inland several miles from the streams at their flood stages
2. Each other

Not in solid stands as are the pine in our southern forests, but widely scattered in the dense tropical forest in which there are perhaps a hundred different species of trees in one square mile

IV. Steps in gathering rubber

1. Search for rubber trees
2. Path cleared from tree to tree
3. Camp built
4. Trees gashed and cups attached to catch latex
5. Sap collected same day trees were gashed or the following day
6. New gashes cut when latex is being collected
7. Return to camp and coagulation of latex over a fire
8. Transportation of the rubber collected during several weeks or even months thru the forest to the nearest stream and thence by canoe to the rubber dealer
9. Shipment of cargoes of rubber by the dealer down the Amazon by steamboat

V. Difficulties of the natural environment under which the rubber gatherers work

1. Dense broadleafed evergreen forest, entangled with thick woody-stemmed vines and having mosses, ferns, and some

flowering plants attached to the trunks of trees, makes it very difficult to clear a path.

2. Rapid growth of the jungle, due to continuous heat and heavy rains, chokes the path in a short time and necessitates fresh clearing.
3. Sultry hot days, similar to July days of the Middle West of the United States, result in little human energy or desire to work.
4. Millions of insect pests torture man and carry diseases.
5. Floods and changing courses of the waterways, which are the only available highways, render navigation dangerous part of the year.
6. Swampy conditions, due to flattish surface and heavy rains, make travel in the forest difficult.

VI. Lack of native labor, due to,

1. Sparse population

Para.....	984,000 people
Amazonas....	460,000
Acre.....	95,000
	1,539,000

This means an average of only one person in one and a quarter miles, about as sparse a population as that of the Sahara.

2. Little desire on the part of the Indians to work for white man

The Indian can make a relatively easy living by working only a few hours each day at fishing, hunting, and migratory farming.

3. Emigration from Amazonas of many "Cearense"

These people had been driven out of Ceara by successive droughts, but are now returning because of large irrigation works under construction there.

Thru this study the following conclusions are reached.

(1) Destruction of the more easily accessible trees

The easily accessible trees close to the mouth of the Amazon and along the shores of the Amazon and its major tributaries were the first to be exploited. The methods used by ignorant and unsupervised rubber-gatherers ruined many of the rubber trees. Gathering rubber now means longer journeys for the Indian up small streams, navigable only by canoe, and back from the stream

into the dense tropical forest. This increases the cost of producing rubber not only because of the longer distance the rubber has to be shipped, but also because of the added expense of sending foodstuffs and other supplies to the rubber gatherer.

(2) Shortage of native labor

(3) Importation of middle-latitude laborers impracticable

a. They are not accustomed to work in continuously hot, wet climates.

b. There are no densely-populated middle-latitude regions, near Amazonas, where a cheap labor supply is available.

DEVELOPMENT OF RUBBER INDUSTRY IN OTHER PARTS OF WORLD

When financiers sensed the coming automobile age and the increasing amount of rubber which would be needed for tire manufacture, they became concerned about the future rubber supply. The wild-rubber industry of the Amazon Basin and of the Congo region in Africa, which was second to Brazil in rubber production, did not appear to them capable of profitable extension. A dependable source for future rubber, they concluded, would be plantations, where difficulties of transportation could be lessened, where rubber gatherers could be supervised, and where scientific methods of tapping would prolong the life of the tree. What did these capitalists have to consider when they were investigating the feasibility of starting rubber plantations? (1) Would the rubber tree grow under cultivation? (2) What regions in the world have the climate for rubber trees? (3) Of these regions with suitable climate, which have or are near to cheap but dependable labor?

CULTIVATION OF RUBBER TREE

Seed from the Pará rubber tree of Brazil was collected by a Mr. Wickham and carried to Ceylon in the late 1870's. There they were planted in the Royal Botanical Gardens. In the 1890's it was reported that the cultivation of the rubber tree had proved successful, and that the Pará rubber tree gave a higher yield than any other with which they had experimented.

CLIMATE SUITABLE FOR THE RUBBER TREE

An investigation of the climate of the Amazon region where the Pará tree is native is necessary at this point. (See Dr. Haas's article "The Amazonas Region" in November number of the *Journal of*

Geography.) Amazonas is characterized by continuously high temperatures thruout the year, rainfall of at least 60 inches, a short season which is less rainy than the seven or eight months wet season but rarely even a month which is rainless.

Where are there regions in the world with the rainy tropical type of climate which prevails in Amazonas? The criteria to be used in the selection of regions with Amazonian climate are three: (1) heavy rainfall well distributed thruout the year, (2) low-land—below 1,000 feet, (3) within 10 degrees of the equator. Then follows the application of these criteria to two types of maps: surface, and seasonal rainfall. Then check conclusions by using the map which is published in the pamphlet "Types of Climate" by Drs. Jones and Whittlesey (University of Chicago Press).

LOCATION OF RUBBER PLANTATIONS

Where in these rainy tropical lowlands have plantations been established? By the use of the index, several recently published geography textbooks are investigated, and a list of regions where there are rubber plantations compiled. In 1922, between 80 and 90 per cent of the rubber crop of the world came from plantations in Malay, Ceylon, Java, Sumatra, Borneo, and other scattered areas in rainy-tropical southeast Asia.

What advantages have these regions over Brazil? These two points are clear. (1) The islands and the narrow peninsula of Malay offer proportionately more land touching the sea or very close to the sea than does a continental land mass of equal area. This means there are many sites for plantations which may have their own seaports. This location facilitates greatly the shipping of plantation produce and the receiving of supplies. (2) Nearness of these lands to India and South China, where there is a dense population accustomed to work in the fields under a tropical sun, makes it profitable to import cheap but intelligent labor.

A DISADVANTAGE OF THE LOCATION OF THE EAST INDIES AND MALAY

The establishment of plantations in the Malay-East Indies region removed the chief producing area farther from the largest market than it had been when located in Brazil. The United States uses about 70 per cent of the raw rubber produced each year. The leading rubber port, Singapore, lies fully three times as far from New York City, the chief rubber-importing port, than does Belém, which formerly was the first rubber port of the world. This disadvantage of greater distance

is partially offset by the fact that Singapore is on a well-established trade route, the Mediterranean-Asiatic, along which ply many freighters that call there. This makes available to the rubber planters many competing lines, which tends to cut the freight rate to a lower figure than would be possible if the rubber planters were far from a main route and had to bid to attract ships to come for their rubber.

FUTURE OF AMAZONAS

Brazil realized, too late, that the chief industry of Amazonas was slipping away. In an effort to attract some planters thither, the Brazilian government offers land to be used for cultivated rubber free for 99 years. They also promise reductions in the export tax on rubber from plantations. Only a few planters have seized the opportunities there. Amazonas has great possibilities for the rubber plantation industry, and if it becomes possible to obtain a suitable labor group, it may again have a rubber boom.

FOREIGN TRADE ROUTES OF BOLIVIA

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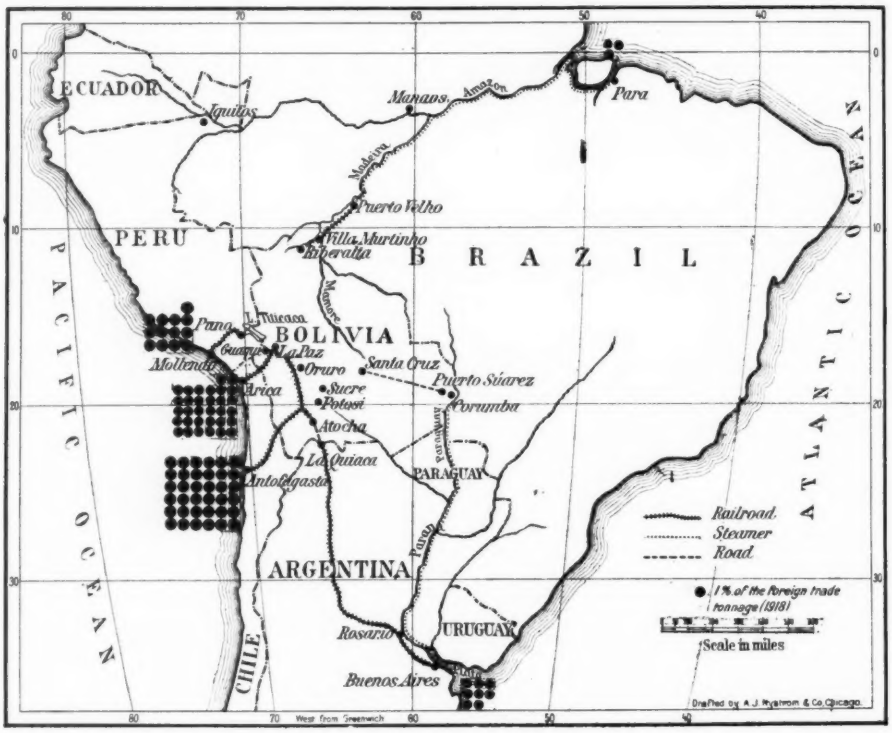
A vast country over twice the size of Texas, but with a total population no larger than that of Chicago, Bolivia has the distinction of being the most sparsely settled of the independent countries of South America. Moreover, nine-tenths of the civilized inhabitants are to be found on the lofty plateau occupying the southwestern one-third of the country. The tropic lowlands making up the remainder of the area are occupied by scattered Indian tribes. Three factors are primarily responsible for this segregation. Bolivia lies entirely within the tropics and only on the plateau section are the inhabitants lifted free of the steaming tropic lowlands. In addition this highland is highly mineralized and it is upon the exploitation of these mineral deposits that Bolivian foreign trade is based. Lastly, this section is nearest the Pacific coast, the best outlet for its products.

As a result of these influences the plateau has become the economic center of gravity of Bolivia and it is here that the routes of trade naturally focus. The three provinces of Potosi, La Paz and Oruro on this highland in 1918 consumed 94 per cent of the imports and shipped 89 per cent of the total exports of Bolivia.[1] The difficulties

[1] Unless otherwise stated all data are for 1918.

attendent upon road and railroad building in such a region are sufficient to tax the resources of a wealthier nation than Bolivia. The average height of the plateau is about 12,000 feet but it lies between still higher ranges flanking it on either side. Even by using the best passes this necessitates an added climb of from one to three thousand feet with an equal descent to the plateau. In addition the surface of the latter is extremely rough, being crossed by many ranges and valleys. La Paz, for example, the capital and metropolis of the country, lies 1400 feet below the general plateau level. To reach the city from Viacha on the



Sketch map showing the principal foreign trade routes of Bolivia.

plateau rim above was an extremely difficult engineering feat and cost almost $2,000,000. The maximun grade there is 7 per cent and the section is electrified. It is little wonder that with such natural difficulties Bolivia with ten times the area has fewer miles of railway than Uruguay.

Like most Andean countries Bolivia has both "front" and "back" door approaches. Inasmuch as it is an inland country all foreign commerce routes pass thru bordering nations. With the Pacific

only about a hundred miles away measured in an air line, it is natural that the three railroads to this coast constitute the "front doorway" and care for 89 percent of the foreign trade tonnage of the Republic. Three ports handle practically all of this latter traffic. Three routes also lead eastward across the plains to the Atlantic making the "rear door" exits. One of these reaches the plateau, the remaining two serve the lowlands only.

FRONT DOORS

The Pacific is Bolivia's main street and three terminal ports handle the bulk[2] of traffic bound thither. Mollendo in Peru, and Arica and Antofogasta in Chile are all open roadsteads, loading and unloading of goods is by lighter and dependent, therefore, upon weather conditions. Arica has a slight advantage over the other two in that a tied island gives protection on the south.

The Mollendo-La Paz route has a length of 529 miles, including Lake Titicaca which serves as one link in the journey. The length of this route which is twice that of the Arica-La Paz line, the two extra transhipments required at either end of Lake Titicaca, together with the fact that the northern section of the plateau is the least productive of mineral freight and is sparsely populated has made this route gradually lose in competition with the two farther south. (See map.) In 1918 Mollendo handled only 13 per cent of the total foreign trade tonnage of Bolivia. It possesses, however, certain attractions not found on the other routes. The beautiful oasis of Arequipa at an altitude of 7,500 feet, offers a pleasant stop-over to passengers wishing to make more gradual the change to high altitudes, while the Inca ruins near Lake Titicaca are of interest to tourists. The number of passengers carried in 1918 was over twice that going via Arica.

The Antofagasta-La Paz road is the longest of the three Pacific railroads, being 727 miles in length. Tho 50 per cent longer than the Mollendo route it has no lake transshipments tho a break in gauge necessitates one change at Uyuni, and in addition it possesses the tremendous advantage of a more lucrative territory. Not only does it carry minerals from southern Bolivia but it also serves as carrier for the nitrate, borax, and copper of northern Chile. It handles about 36 per cent of Bolivia's foreign trade tonnage, ranking first among the outlet ports. It is losing patronage, however, to the Arica-La Paz route.

[2] Of 241,366,902 tons of traffic moving via the Pacific over 91 per cent passed thru the three ports mentioned.

The Arica-La Paz government line was the last of the three Pacific roads to be built,[3] but it has come to be one of the most important. Its chief advantages over its two rivals lie in its shortness (279 miles), its directness, and the possession of a somewhat better harbor at Arica. No transhipment of goods is necessary thruout its whole length and its time, 20 hours, is less than one-half that of either of the other two Pacific routes. It competes with the Antofagasta line for the mineral output of southern Bolivia. Its chief handicaps are a "rack and cog" section of 20 miles where a 6 per cent grade is found. Trains have to be taken up this portion a few cars at a time, resulting in congestion of traffic. Government ownership and inadequate rolling stock have served to limit its efficiency thus far. Arica in 1918 handled almost one-third of the total foreign trade of Bolivia, an amount slightly less than the Antofagasta route.

Only 11 per cent of Bolivia's foreign commerce uses the routes reaching the Atlantic. Of this about 8 per cent goes via Argentine and 3 per cent via Brazil. That the eastbound traffic is small is to be expected. The only route reaching the plateau is still incomplete. In spite of this handicap it is significant that it handles one-half of all Bolivian traffic thru Argentine. The other Atlantic routes penetrate the Bolivian plains only as mule and cart roads, primitive transportation which can expect only a very limited tonnage.

BACK DOOR EXITS

The most important of the "back door" exits is the one which, when completed, will furnish a thru rail route from La Paz to Buenos Aires. The only gap remaining, but which is now under construction, is 125 miles between La Quiaca in northern Argentine and Atocha across the boundary in southern Bolivia. Pack mules or, in winter, automobiles, carry goods and passengers between these rail heads. Tho this is a long rail haul (1637 miles) it should provide a market for northern Argentine agricultural products as well as some manufactures, even from Buenos Aires. Minerals in the extreme north to which the Pacific coast routes are inaccessible will also find their way out by this line. Even with the transhipment now necessary, over 90 per cent of the Bolivian exports via this route were minerals. When completed[4] this road will form the second transcontinental railroad of South

[3] This road was constructed by Chile according to the treaty of 1904 by which Bolivia surrendered its littoral to the other country.

[4] The contract for completing this work was let to an American firm in 1921 and the latter has agreed to complete the section in 1925.

America. It will have the advantage over the other from Valparaiso to Buenos Aires of freedom from snow troubles and will provide for passengers at Mollendo, bound for the Argentine capital, a cut-off of two or three days even when the southern route is open. At present this northern journey requires six days.

A second route to the Atlantic connects the Bolivian lowlands with the mouth of the Plate by means of a combined overland and river route. A mule and cart road runs from Santa Cruz, a city of 30,000 about 730 miles southeast of La Paz, eastward to Puerto Suarez on the Paraguay River 391 miles distant. Here a regular steamer line connects with Buenos Aires via Corumba the Paraguay, Parana and Plate, a river journey of 1733 miles, or a total distance from Santa Cruz of 2220 miles. Tho the plains are rich in agricultural resources of a tropical nature the limitations of climate and transportation leave most of this region undeveloped and this route accounts for less than a thousand tons of Bolivian export.

The Amazon-Maderia-Mamore route offers an outlet to the rubber forests of the Bolivian plains in the north. Riberalta on the Teni, a tributary of the Mamore, is the rubber center of this region. The route to Manaos or Para involves a river steamer journey down the Beni 125 miles to Villa Murtinho on the Mamore, thence around the Madeira-Mamore falls by rail 194 miles to Porto-Velho. From here steamers connect with Para. Rubber and Brazil nuts are the chief commodities exported. This route is about the same length as that via the Paraguay and Buenos Aires.

The emphasis given the plateau-Pacific traffic seems quite likely to remain if indeed, it does not grow relatively greater. Minerals make up about 90 per cent of the Bolivian exports and dominate the entire economic life of the republic. Agriculture, stock raising and the forest industries of the eastern plains must remain in a comparatively backward stage of development for many years to come. The shift in the world's principal centers of supply for quinine and rubber are significant. In so far as plateau traffic finding its way out by the Atlantic is concerned it would seem that this too must be limited. The long haul by rail or small river steamer is expensive for ores, the principal commodity available.

THE TRANSPORTATION PROBLEM OF HIGHLAND COLOMBIA

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Colombia is an undeveloped country. In this respect it is similar to the other countries of tropical South America. The problems which arise in the development of any tropical country are, in Colombia, complicated by the presence of high mountains and plateaus, which, on the one hand, give asylum from the fever-infested lowlands, and on the other, render these asylums difficult of access from the outer world.

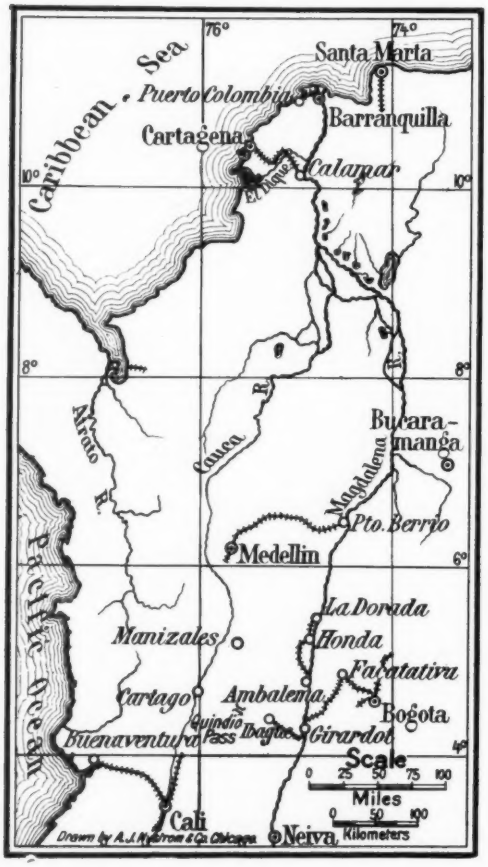

FIG. 1. Map of Highland Colombia

Highland Colombia is furrowed by three longitudinal valleys, sloping northward to the Caribbean (Fig. 1). Betweent hese valleys there are high mountain ranges with elevated, enclosed basins and plateaus. The easternmost range is the largest of these, and forms a very real barrier to transportation between the Magdalena valley and the Orinóco Lowlands to the east. In the south, the three ranges converge in the mountain knot of Pasto, in which the longitudinal rivers have their sources. So rugged is the relief of this section that it has always formed an interruption to north-south communications. Here the Inca Empire founded its northern boundary, failing to penetrate the natural obstacles into the land of the Chibchas. Here the boundary between the modern states of Ecuador and Colombia has been drawn, partitioning the New Grenada of the Liberator, Bolivar, into naturally defined units; and here the dream of a Pan American railroad will receive its rude awakening.

The climate of this section of Colombia depends on altitude. The lowlands, or *tierra caliente*, are tropical, and in default of good sanitation, are unhealthy. The white people in Colombia have always sought the elevated plateaus where there are cooler temperatures, altho even in the uplands, the true temperate zone conditions are not found, since the stimulus of variability from day to day is noticeably lacking. These elevated plateaus of the interior are, however, the regions best suited to white habitation, and are the seats of Colombia's largest groups of white population. Bogota, the capital, is located on one of the largest of these, at an elevation of 8659 feet (2640 meters). Consequently, one of the most important of Colombia's transportation problems is the connection of Bogota with tide water.

THE ROUTES TO BOGOTA

In undeveloped countries, in the early stage of transportation development, rivers will be utilized wherever possible as a more economical means of communication than overland roads or trails. A later stage of development will see the rivers succeeded by railroads, built sometimes even at right angles to the trend of the rivers, if the geographic conditions decree that a transverse railroad would be more economical than the more usual down-valley route. Colombia's transition from river and trail transportation to railroads has gone on by slow degrees, as would be expected in a tropical country. The rail links have often replaced the trails as supplementary to the river, thus increasing the importance of the Magdalena route. Yet from the first, the Colombian government has had in mind a rail route from Bogota to the Pacific, free from any river navigation. Thus many of the present railroads, forming now a part of the Magdalena route, are located in reference to a transverse Pacific route, and their poor locations as regards the river navigation are resulting in delays and expenses disastrous to the rapid development of the country. Let us examine these two routes in detail, weighing their advantages and disadvantages.

THE MAGDALENA ROUTE

Obstacles to navigation on the Magdalena River begin at its mouth. Here the absence of the scouring action of tides in the Caribbean Sea has allowed the growth of sand bars, which prevent the entrance of ocean vessels or the exit of river boats. Very commonly, on tideless seas, the ports which grow up as outlet points for river

valleys are located, not at the river mouths, but a short distance away where the harbor is not constantly filled up by the river's silt. In accordance with this principle, Cartagena (Fig. 2), founded in 1533, is located about 72 miles (115 kilometers) southwest of the Magdalena mouth, and about 15 miles (24 kilometers) north of a high water distributary outlet known as El Dique. In colonial times this outlet, which leaves the main river near Calamar, was kept clear of vegetation and used as a canal. All the river traffic made use of it and was thus able to meet ocean shipping directly at Cartagena. But with the decline of Colombia's trade following the Wars of Independence, the canal was allowed to fill up. At the present time it is marked by little

FIG. 2. The water front at Cartagena. The harbor is protected by an off-shore island and is reached from the open sea thru a narrow channel.

more than a chain of swamps, except at high water periods, when the whole swampy coastal area is flooded. Until recently there has been no serious attempt to dredge the old canal, except for short distances by a sugar company. In the summer of 1922, however, a contract was given to an American company to dredge El Dique. It was estimated that the work would require about three years.

At present there are two railroads, built from river ports to corresponding ocean ports, which serve as outlets for the Magdalena.

ROUTE FROM THE SEA TO BOGOTA[1]

	Length of Sections in	
	Miles	*Kilometers*
Puerto Colombia to Barranquilla		
Barranquilla Railroad, one-meter guage	23	37
Barranquilla to La Dorada		
Colombia River Navigation Company	537	864
La Dorada to Ambalema		
La Dorada Extension Railroad, three-foot gauge	69	111
Ambalema to Girardot		
Colombia River Navigation Company	43	70
Girardot to Facatativa		
Colombian National Railroad, three-foot gauge	82	132
Facatativa to Bogota		
La Sabana Railroad, one meter gauge	25	40
Total, Puerto Colombia to Bogota	779	1254

One railroad runs from Cartagena to Calamar. This line serves to carry off only the overflow of freight during rush times. The shorter, older, and more important line runs from Puerto Colombia to the big river port of Barranquilla. The larger part of the export and import freight of the Magdalena is handled on this line.

The river steamers begin their ascent of the river at Barranquilla. As far as Calamar the channel is wide and deep, and even at low water the boats can sail at night. Above Calamar, however, conditions get steadily worse. Navigation is often dangerous during low water because of snags and sand bars. The boats always tie up at the shore during the night. As the river is ascended the delays become more and more frequent, until, above Puerto Berrio, delays are common even during high water, and communications often cease entirely during low water.

The first real interruption of navigation occurs at Honda. Here a series of impassable rapids separate the lower river from the upper river. A railroad has been built around these rapids, and is extended downstream 19 miles (30 kilometers) below Honda to La Dorada in order to avoid some large meanders.[2] La Dorada, the upper end of navigation on the lower river, is 537 miles (864 kilometers) from Barranquilla. The railroad carries traffic to the upper river navigation at Beltran and Ambalema, a distance of 69 miles (111 kilometers).

Navigation on the upper river is even less certain than on the lower river. It is often interrupted altogether in the dry season. The currents are swift, especially at high water. The head of navigation

[1] W. S. Barclay, The Geography of South American Railways. *Geog. Jour.*, Vol. 49, (1917) p. 62

[2] Mapa del Rio Magdalena: Oficina de Longitudes, Bogota, 1920

is sometimes placed at Neiva, but this point cannot even be reached by canoes during low water. Practically the highest point reachable even by the small boats drawing only 3½ feet when loaded is Girardot, 43 miles (70 kilometers) above Ambalema.

The transportation facilities between Girardot and Barranquilla are entirely inadequate for the volume of traffic which seeks an exit over the Magdalena route. "There are 10 steamers (Fig. 3) on the lower river, which, during seasons of high water, can handle every 20 days about 6,000 tons of thru up-river freight, and 8,000 tons of down-river freight. During this same time the eight steamers on the upper river can each make six round trips, bringing to Beltran (the station below Ambalema on the Dorada extension railroad) 5,796 tons

FIG. 3. A river steamer on the Magdalena. The forward part of the upper deck is very comfortable when the steamer is moving. Notice the wood stacked on the lower deck for fuel. This is loaded on the boat at various points along the river, and is cut and prepared by wood choppers from the forests of the Magdalena Valley.

of freight, and carrying from Beltran to Girardot 4,500 tons. Also during this same period as much as 2,000 tons of freight often arrive at Honda from southwestern Cundinamarca, and 4,000 tons from the department of Caldas and the mountains of Tolima. . . . In other words, if there is sufficient water in the upper river, 11,796 tons of export freight may arrive at La Dorada every 20 days, but only 8,000 tons can be shipped farther down."[3] This description holds for periods of high water. Unfortunately the peak of shipments comes during the coffee harvest in May and June, which coincides with a low water

[3] P. L. Bell, Colombia: A Commercial and Industrial Handbook, p. 245, Washington, D. C., 1921

period. The coffee is regularly held up all along the river, waiting for high water.

The Dorada extension railroad traverses a level country where no tunnels and only one long bridge are necessary. Its upkeep cost is lower than on any other Colombian railroad, a fact which is reflected in its poorly-graded, dirt-filled roadbed, and in the bad condition of its rolling stock. The line is projected from Ambalema to Girardot, which, when completed, will eliminate the present unsatisfactory use of the upper river.

Girardot is 1,066 feet (325 meters) above sea level. The Bogota tableland lies at an elevation of 8,951 feet (2,729 meters). Thus, having arrived at Girardot, or Honda, in the heart of Colombia, one is still in the *tierra caliente*, and with a hard part of the journey to Bogota in prospect. Before the completion of the railroad all traffic was by mule or ox-cart, over the trail from Honda to Facatativa on the edge of the tableland, or over the cart road from Camboa, a point on the upper river between Ambalema and Girardot. If the railroad from Bogota to the Magdalena had been planned as a part of the Magdalena route, undoubtedly it would have followed the old mule trail to Honda, and thus the navigation on the upper river could have been avoided. Even as early as 1880, however, when the Girardot railroad was begun, the plan of a Pacific outlet had been conceived and the separate links projected. Girardot, being opposite the Quindio Pass over the central range, a much used and well known pass in early times, was chosen as the points where the Pacific railroad should cross the Magdalena.

Altho commenced in 1880, the railroad to Girardot was not completed until 1909. For the first time Bogota was accessible from the sea without use of horses or mules. It was then believed that Colombia's development would begin in earnest; but the Girardot railroad has not brought the desired result. False economies in construction make it necessary almost completely to rebuild the line before it can carry a heavy traffic. Then the foolish blunder of a change in guage was made. The line from Girardot to Facatativa is a narrow, three-foot guage, but from Facatativa to Bogota a guage of three feet, six inches has been used. This unfortunate circumstance makes necessary an extra handling of freight at Facatativa. The expected reduction of freight rates has not come. The railroad is losing money. In 1910 only 12,000 tons of freight were carried, more than half the traffic still going by way of the old Honda mule trail, or by the Camboa cart road. The expense of shipments to Bogota of heavy merchandise, for example, adds approximately 90 per cent to the New York invoice

value.[4] Because the railroad was planned as a link in an as yet unfinished project, it will not perform its function of opening up the plateaus for commerce until the project is wholly completed and Bogota has an all-rail outlet to the Pacific.

The Projected Route to the Pacific

Generally speaking, trade flows most easily down valley, but other factors may offset the down-valley tendency. Until recently Europeans have stood in awe of tropical regions. Attempts at adaptation were made in many places, but with little success. Modern sanitary engineers are beginning to make headway, at least in the conquest of disease, but hitherto the lowlands have been avoided wherever possible in the settlement of tropical countries. Thus the construction of a railroad to the Pacific, independent of travel thru the Magdalena Valley, has received much support. Let us examine the possibilities of such a transverse route.

As early as 1878 construction was started on the railroad from Buenaventura to Cali, in the Cauca Valley, as a portion of the ambitious Bogota-to-Pacific line. The products upon which this railroad could depend for support until connected to Bogota were chiefly coal and coffee. The coal is located near Cali and is bituminus of good quality. Mining was carried on before 1878, altho the operations were primitive and limited by the isolation of the locality. If access to the sea would have brought ready access to markets for the coal, the railroad would probably have been completed very soon. It was not completed, however, until 1914, the same year that the Panama Canal finally made access to the Pacific synonymous with access to markets. This field should become prosperous with the demand for coal at the canal.

The Pacific railroad, as this line is called, is 108 miles (174 kilometers) long. It crosses the western range of the Andes by an easy pass, La Cresta del Gallo, at an elevation of 5,217 feet (1,590 meters). Unfortunately, the portion of the line on the western slope is poorly constructed and would not accommodate a very heavy traffic in its present condition. From Cali the main line crosses the Cauca and runs northward thru Palmira, Cerrito, Cucacam, Buga, and San Pedro to Tulua, a distance from Cali of 42 miles (67 kilometers). Immediate extension of this line is planned to Cartago, 64 miles (103 kilometers) north of Tulua.[5] At the present time only the Cordillera Central lies between Bogota and a thru Pacific connection.

[4] P. L. Bell, Op. cit., p. 245

[5] Correspondence with the United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C.

On the Magdalena side of this range a railroad has been completed from Girardot to Ibague, from which the ascent to the Quindio Pass is not at all difficult. On the Cauca side the route over the pass has not been surveyed, but no serious engineering difficulties are expected. The Quindio Pass is about 12,000 feet (3,661 meters) in elevation, and its approaches are easy. "Even in the most mountainous sections the line will pass thru a rich coffee-producing country and local traffic will probably be great."[6]

The railroad from Bogota to the Pacific will be approximately 556 miles (895 kilometers) long, or 223 miles (359 kilometers) shorter than the present unsatisfactory rail and river route to Puerto Colombia. The total cost of the completion of the line, the rebuilding of certain portions already completed, and the erection of docks and making of improvements at Buenaventura, is estimated roughly at $50,000,000.[7]

FIG. 4. A typical river-side village on the lower Magdalena. By proper sanitation, tropical diseases can be eliminated, and this section of Colombia can become a great producer of sugar, cocoanuts, corn and other tropical products.

This cost, however, might be justified by the lower freight rates from Bogota, which, Bell says, would be about 50 per cent lower than at present; by the local agricultural traffic, which would use the railroad rather than the slow Magdalena route; and by the Cali coal exports, which should become very active.

It is not certain how much a thru rail connection from Bogota to the Caribbean would cost. Instead of the problems of a mountain railroad, a railroad in the tropical Magdalena lowland (Fig. 4) would be faced by problems of sanitation, decay of equipment, and the like, and it might prove almost as expensive in the long run as a transverse line. As far as immediate traffic is concerned, the Pacific railroad would tap freight from a relatively well developed section of Colombia,

[6] P. L. Bell, Op. cit., p. 296
[7] Ibid.

at once, while the production in the tropical valley would be small for some time to come. If, however, Colombia's future prosperity is the result of its position at one end of an inter-zonal exchange between temperate North America and the tropical Caribbean countries, then the Magdalena route will come into its own. The rich agricultural lands will send their products easily and naturally down valley, probably by rail, to a Caribbean port. Those who believe in the intensive development of tropical lands in the future will regard construction on the Magdalena route as the only course leading to the development of Colombia's potentially richest territory.

THE ISLAND OF OAHU

W. M. DAVIS

Harvard University

On reading the two articles on Hawaii in the February number of the *Journal of Geography*, the question rose in my mind, as it often has on reading other articles: What conception of geography is held by their authors? Have they not, in the modern reaction against mere locational geography, gone too far and allowed that phase of geography insufficient attention? The following topics are treated in the first article: area, population, importance (as to position, crops, winter resort, out-post of tropics), race problems, insularity, remoteness,

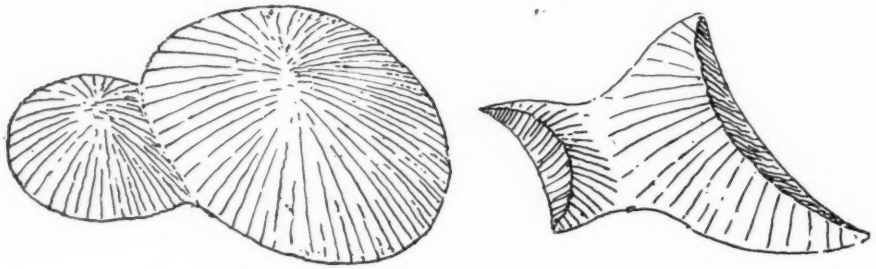

FIG. 1. (At left) Initial form of the volcanic doublet
FIG. 2. (At right) Residual doublet, after loss of part of each volcano

vulcanism (8 lines), agricultural products, commerce, scenic beauty (15 lines), notable scientific experiments, climate (35 lines), and irrigation. The second article gives about the same in attention to the physical features of the islands as the first.

I presume that both articles were written with the object of presenting to the readers of the *Journal* a certain amount of information which it was supposed they did not already possess; but

if so, why is the fundamental topic, *the form of the islands*, so insufficiently treated? If the articles had been prepared for teachers of economics, a brief statement of physical features would probably suffice for their needs; but in articles prepared for teachers of geography, would it not be appropriate to introduce as much information about the *form* of the islands as about any other topic? Does not the teacher of geography wish to know, is it not, indeed, her duty to know, *what* the islands are, as well as where they are, how large a population they have, and so on? Unless a teacher knows *what* the islands are, all other items of information concerning them will be vaguely located, without specific relation to their surrounding features; and the relation of man and the earth in Hawaii will necessarily be left indefinite; for altho a fair number of items about man are given, so little is told of about the earth that no clear relation between man and the earth can be established.

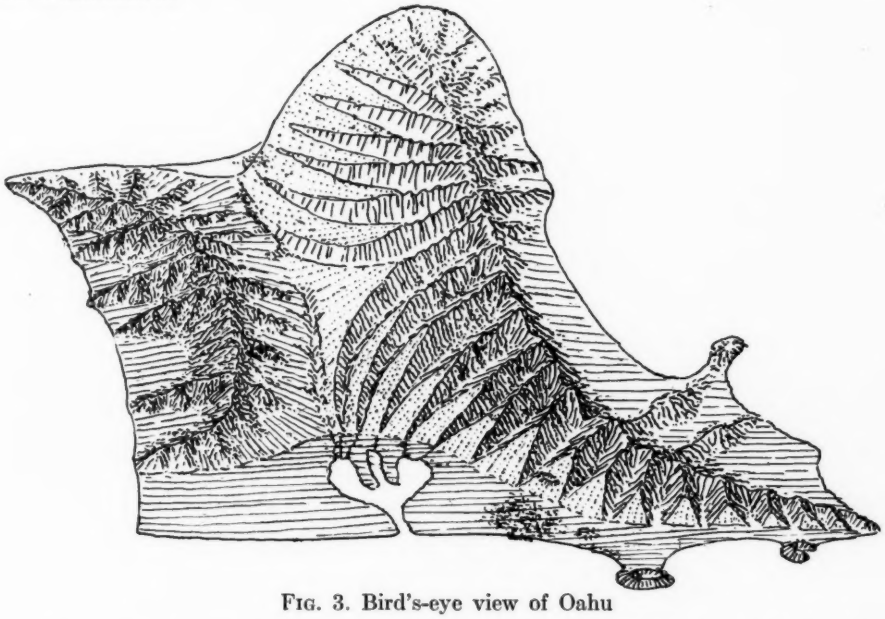

FIG. 3. Bird's-eye view of Oahu

In order to illustrate what I mean by a description of physical features, I submit the following account of the island of Oahu, the only one of the Hawaiian group that I have seen.

Oahu is an incomplete volcanic doublet, beautifully represented on a large-sheet contour map, 1:62,500, published by the United States Geological Survey. The present island, measuring twenty-five miles east-west by forty north-south, differs from the original form produced by eruptive construction (Fig. 1), by the loss of nearly half

of the western or older cone and of more than half of the eastern or younger cone (Fig. 2); and further by the dissection of the residual half-cones in bold mountainous forms (Fig. 3); the older western one, the Kaala range, of which the greatest height is 4030 feet, being much more dissected than the younger eastern, the Koolau range, where the greatest height is 3100 feet; also by the addition of a number of limestone coastal plains, now partly overwashed by volcanic detritus from the mountains; several such plains occupy the wide valleys of the western coast; a small one lies in the northern re-entrant angle between the two cones; and the largest stretches all along the southern coast; and further by the addition of a coastal plain almost wholly composed of volcanic detritus at the base of the great cliffs, or Pali, in which the broken-down younger cone faces the mid-eastern coast. These cliffs of the younger cone, being on the windward side of the island, receive a heavy rainfall and are clothed with verdure; while the deeply dissected seaward slopes of the older cone on the leeward side of the island are relatively dry with scanty vegetation.

Several small craters of recent eruption are seen; for example, Diamond Head, the westernmost of several salients on the eastern part of the south coast, now strongly fortified. Where the southern plain broadens in its re-entrant inter-cone angle, it is occupied by the branching, drowned-valley embayments of Pearl harbor. Honolulu lies on the plain between the eastern branch of the harbor and Diamond Head. The small town of Waialua lies in the inter-cone re-entrant of the northern plain. The surviving slope of the eastern cone is trenched by many divergent valleys which radiate to the northwest, west and south; they head against the crest of the Koolau range which they notch and sharpen; they are separated in their close-set upper courses by acutely serrate ridges, and in their wider-spaced, canyon-like lower courses by undissected short-sectors of the original volcanic slope. Many of the best sugar-cane and pineapple plantations lie on the smooth surfaces of the gently sloping short-sectors; some of these plantations are irrigated by water led by canals from the neighboring valley heads; a few of them by water brought from the streams of the eastern scarp thru tunnels in the sharp dividing range. A narrow gage railroad runs from Honolulu westward along the southern plain and around the western and northern coasts to the middle plain of the eastern coast, which is largely given over to pineapple plantations. The flat-floored valleys of the western coast have extensive sugar-cane plantations, but they are at some disadvantage from lack of water. A good road ascends a valley from Honolulu to a notch in

the Koolau range and descends by a winding course to the eastern plain, offering superb views of the Pali. Another road, crossing several fine canyons on the way, leads from Honolulu over the flat col between the two half cones, where the United States Army has most salubrious barracks at an altitude of 850 feet, and then down to Waialua on the little northern plain.

Is not an account of this kind worth while? Does it not, with the aid of its hastily drawn figures, enable a reader to form a fairly definite mental image of Oahu; and that image being once formed, is it not then an easy matter to place various items about the island in their proper location? Honolulu, for example, not specifically located in either of the articles above referred to, is here given a very definite location. The famous Pali is concisely placed and explained. The position of the Oahu sugar-cane and pineapple plantations is also presented in a way to be easily apprehended and remembered. If the other Hawaiian islands were similarly described, would our teachers not profit? To be sure, the course of Empire would not have been appreciably deflected if Honolulu had been on the north side of Oahu, and if the Pali had faced the west coast; but as a simple matter of fact they are on the south and east sides of the island, and in the interest of geographical truth, it is well to say so. Even for those who regard geography as only a study of locations, it is helpful to acquire a concept of land forms preparatory to locating cities and industries; while for those who regard geography as a science, embracing a rational study of the relations of man—or better, of life—to environment, a clear concept of land forms is simply indispensable. Without it, cities and industries and everything else float about vaguely, instead of being anchored securely. Indeed, without a clear concept of the forms of the land—that is, without any "GE"—our science deserves no more of its name than 'Ography.

GEOGRAPHICAL PUBLICATIONS

Ellsworth Huntington and Stephen Sargent Visher. **Climatic Changes: Their Nature and Causes.** 329 pp., 13 illustrations, 10 tables. Yale University Press, New Haven, 1922

Of all subjects in the broad field of geography, perhaps "climatic change" is least amenable to scientific study—partly because the data are scanty and contradictory, partly because the topic bristles with hypotheses which are likely to become an obsession of the author who studies them deeply enough to handle them. Nevertheless, here is a treatise which makes a valiant, and on the whole successful, attempt to approach this refractory subject in a spirit of scientific detachment.

The topics discussed cover an extraordinarily wide range. The important hypotheses which have been set up to account for climatic changes are stated; historical evidence of climatic change since the appearance of human records is recapitulated; climatic changes thruout geological time are investigated, especially those which are indicated by alternations of glaciation and vegetation. The pursuit of these major themes leads into enticing and remote fields—paleontology, electricity, astronomy—in addition to beating paths in the preserves which lie adjacent to geography, such as physiography, meteorology, and history. Probably no one person is competent to judge the quality of work done in all those fields; certainly the reviewer is not. With respect to the two subjects with which he is most conversant, the judgment is contradictory. In the section covering climatic changes within historic time the argument assumes the character of special pleading in support of a hypothesis, i.e. *all* the evidence offered supports the theory of change. On the other hand, the chapter dealing with the origin of loess seems to be thoroly scholarly. As to the trustworthiness of material and method in the remaining topics, the reviewer is unable to voice a worthwhile opinion.

Those who enjoy speculation in fundamental causes, and those who wish to keep abreast with investigations of climatic change should ponder this book. For special students of glaciation, earthquakes, loess, astronomy, and desert geography, the three tables immediately preceding page one and the index will serve as a sufficient guide to materials in their respective fields of interest. But no one should pick up the book who objects to being jarred out of a complacent and fixed philosophy of the universe; because, notwithstanding possible inaccuracies of statement and unsoundness of method, the volume forces the reader to extend his spiritual horizon and to orient his personal philosophy afresh.

D. S. WHITTLESEY

University of Chicago

Henry H. Clayton. **World Weather.** 393 pp., 281 maps, diagrams, and photos. For sale by Eliot C. French, 604 Pleasant Street, Canton, Mass. 1923. $4.00

"The weather in some form or other affects every living creature. It has been the topic of universal conversation. It is the subject naturally mentioned in beginning a chat with a friend or stranger. It has been the foundation of endless jests and it has furnished a theme for countless poems. . . . The merchant must bring his products from places where they are readily grown to those where they are most needed, and risk their loss by moisture, heat or cold. In the United States ten thousand million dollars are taken from the soil each year. Fortunately nature never completely deprives the grower of needed moisture, but the total difference in value between the amount grown in a year of abundant rain may easily be five hundred million dollars." It is this subject—weather—which so intimately concerns all human beings that the author discusses as a world phenomenon. The fact that the author is chief of the forecast division of the Argentine Meteorological Office and was associated for many years with Bule Hill Observatory commands interest and high regard for the scientific value of the discussion.

The connection between weather changes in widely separated parts of the world; between high and low latitudes; between ocean and continent; and the influence of solar radiation, are presented. The scope of the work is probably best shown by the chapter titles: The Forces Controlling Weather Changes; The Daily Period in the Weather; The Yearly Period in the Weather; Temperature and the Weather; Pressure and the Weather; Wind and the Weather; Moisture, Clouds, and Rainfall; Cyclones and Anticyclones, or Storms and Sunshine; Sky Colors and Visible Signs of the Sky and Air; The Sun and the Weather; Physics of the Air in Relation to Solar and Terrestrial Radiation; Periodicity in the Weather and in Solar Phenomena; Forecasting the Weather; The Meteorology of the Sun. A short statement, at the beginning of each chapter setting forth what is discussed

in that chapter is a time-saving feature to the student. A well-selected bibliography would have added value to the volume.

The volume brings together a large body of information of special value to geographers, to students of meteorology and related subjects, and to the general reader who is interested in that common subject of daily conversation—the weather. The author has given us a book that not only fills a gap in meteorological literature but presents the world atmosphere as a unit such as no other book does. G. J. M.

Mabel C. Stark and Derwent S. Whittlesey. **Major Geographic Regions of North America.** 45 pp., 33 maps and climatic charts. McKnight & McKnight, Normal, Illinois. 1923

Following the method used by Miss Stark in her earlier monograph on the "Geographic Regions of South America," the authors have attempted the difficult task of subdividing North America into its major geographic regions. As explained in their introduction, the subdivisions are based on "contrasts in the dominant interests of the inhabitants," these interests being expressed by the economic, political, or social conditions. This approach to the study of regions from the human standpoint is essentially sound since it throws the emphasis on man's activities. The method has already proved its value in the "Geographic Regions of South America," which has been so great an aid to students of South American geography.

The authors have recognized in North America twenty-two major regions. As is to be expected in any subject as complex as the classification of human interests, these regions will give rise to differences of opinion as to their content and outline. Nevertheless, a study of the twenty-two major regions will reveal remarkably few fundamental disagreements. The most obvious of these is the treatment of Alaska. Undoubtedly the authors will wish to extend their "Arctic Canadian Region" thru northern Alaska to the vicinity of Bering Straits, instead of including all of Alaska in the "Region of Rocky Mountains and Plateaus." Possibly, also, the latter region might be divided into a northern portion where because of severe winters and remoteness from markets, agriculture is little developed, and a southern portion, where agriculture with irrigation is found in nearly every valley. The authors will perhaps argue that such divisions should become geographic provinces within their major regions. The naming of the regions might be improved by adopting some uniform method—either after the dominant human interest, or after the locality in which the region is found. The present system appears haphazard. The names used are significant of the chief product, as the "Spring Wheat Region"; or the population grouping, as the "Eastern Urban Region"; or the physiography, as the "Pacific Fiorded Coastal Region"; or the climate as the "Arid Region"; or the political division, as the "Californian Region." Particularly unfortunate of the latter type is the "New England Upland Region," which includes, quite rationally from the regional standpoint, the Adirondack Mountains in New York State. However, these criticisms should not be allowed in any measure to obscure the very real contribution which has been made to North American geography in this attempt to organize our geographic data in a presentable form.

In the text, special mention should be made of the excellent descriptive paragraphs with which the treatment of each region is introduced. Particularly fine is the short description of the "Region of Rocky Mountains and Plateaus." Here is a geographic text, the reading of which is a real pleasure.

As regards the teaching value of these regions, it is the reviewer's opinion that they are most effective after the student has been well drilled in the conditions of the natural environment: the physical features, the climates, and the distribution of resources.

PRESTON E. JAMES

University of Michigan

NATIONAL COUNCIL MEETING

The annual meeting of the National Council of Geography Teachers will be held December 26 and 27, 1923 at the University of Cincinnati, Cincinnati, Ohio, in conjunction with the American Association for the Advancement of Science and the Association of American Geographers. Reduced railroad rates have been granted for the entire United States and for the eastern part of Canada. Purchase a first-class, full-fare, one-way, thru ticket to Cincinnati, and *be sure to secure a certificate on Standard Certificate Form* (not a receipt). After your certificate is validated at the Cincinnati meeting any ticket agent will sell you a continuous-passage return ticket for one-half of the regular fare, by the same route as that followed in the trip to Cincinnati. Please send a postal card reservation to the Secretary if you expect to attend the "Dinner Meeting." This will enable him to make suitable arrangements. Headquarters at Gibson Hotel; rates $2.50 to $10.00.

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PROGRAM

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Auditorium, Chemistry Building

Mark Twain and Geography, Jessie B. Strate,
East High School, Cincinnati, Ohio
Classification and Use of Geographic Principles, E. E. Lackey,
State Normal School, Wayne, Nebraska
Objectives in Geography Work of the Junior High School, W. R. McConnell,
Miami University, Oxford, Ohio
Teaching Geography in Grade Four, Julia M. Shipman,
State Normal School, New Britain, Conn.

Wednesday Evening, December 26

Dinner: *Hotel Gibson at 6:30*
Traditional Geography and Present Trends, Ray H. Whitbeck,
University of Wisconsin, Madison, Wisconsin
Discussion
Annual Meeting of the Board of Directors

Thursday, December 27, 9:30 A. M.

Room 200, Engineering Building

The Bounds of Racial Geography, Robert M. Brown,
Rhode Island College of Education, Providence, R. I.
They Entered Unprepared. What Can We Do? Zoe Thralls,
State Normal School, Indiana, Pennsylvania
The Motion Picture as an Aid in Geographic Studies, William M. Gregory,
Cleveland School of Education, Cleveland, Ohio
The Place of Detail in Geography Teaching, Leonard O. Packard,
Boston Normal School, Boston, Massachusetts

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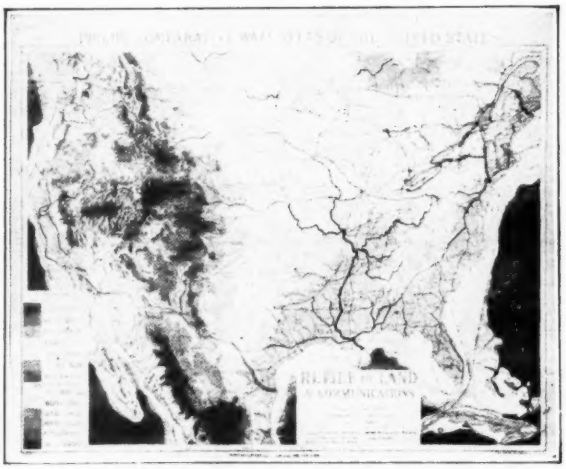

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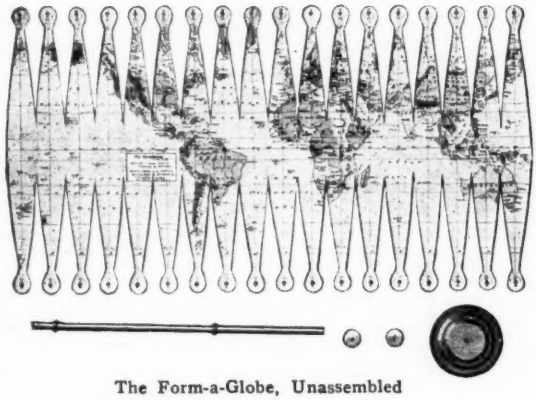

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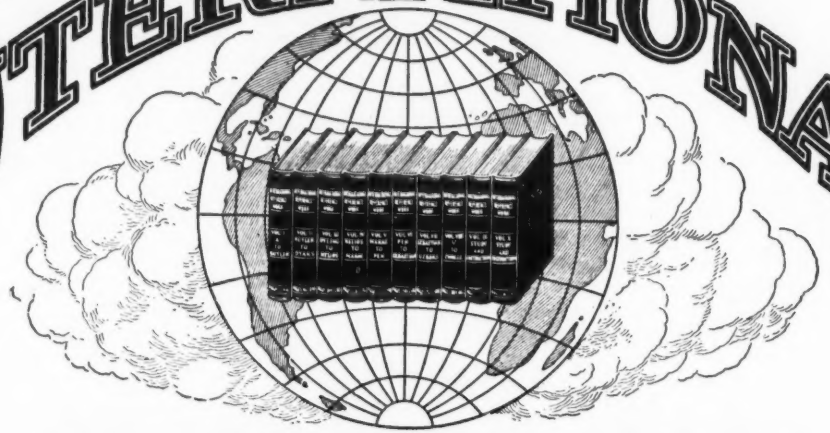

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